

A PRELIMINARY STUDY ON THE PROBLEM OF AIRLINES MAINTENANCE OUTSOURCING

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Abstract: This paper provides a basic flow chart for Airlines maintenance outsourcing operation, meanwhile puts forward a corresponding modular design of PBL maintenance outsourcing management-decision support system.

Key words: Airlines; maintenance outsourcing; management method; maintenance outsourcing management-decision; performance-based logistics

1 Introduction

As China's first new regional airliner ARJ21-700 with fully independent intellectual property rights has been under final assembly line. It has a lot of advantage, as a result, airlines have rushed to order. The regional airlines of Kunpeng Airlines that belongs to Shenzhen Airlines signed a commercial purchase agreement of 100 ARJ21 with Commercial Aircraft Corporation of Shenzhen Ltd., including 50 firm orders and 50 orders of intent. Before, ARJ21 in the domestic has haven a total of 71 orders in which Shanghai Airlines has 5 orders, Xiamen Airlines has 6 orders, Shandong Airlines has 10 orders, Shenzhen Leasing Financial Company has 20 orders, Shanghai Electric Financial Leasing Company has 30 orders.

So we can see that the new regional aircraft ARJ21-700 has very good market prospects in China. Not only that, ARJ21 will also explore the international aviation market. Currently it prepares to set up marketing networks in the United States and Europe, deploy sales networks.

For airlines, when the new regional aircraft is put into operation, it will face a big problem: the aircraft

logistics support work. Because the deficiency of maintenance staff and technology in the domestic airlines, most of the maintenance business is outsourcing. In particular, such as the new regional aircraft ARJ21 has no relevant historical maintenance experience serving as a reference, all the repair activities have to be through practice to search. So Airlines choose to outsource their maintenance business, while the reasonable decision of outsourcing contract is the key to the success of outsourcing. In this regard, the PBL (PBL: performance based logistics) strategy raised by the U.S. Department of Defense has effectively improved weapon system's logistical support capabilities. In 1998, the U.S. Department of Defense in accordance with defense authorization ordinance 912C section has carried out the innovative work of Product Support, that is to say, it has transformed the logistics model to the performance-based logistics model. PBL eliminates the traditional transaction-oriented manner of the weapon system Support, that is, a prime contractor could carry out specific tasks and maintenance works, purchase spare parts in accordance with specified progress. In accordance with PBL, the prime contractor of weapon systems support will determine the support services type and quantity, including hardware sustaining engineering, supply chain management, software maintenance, programmed depot maintenance, etc., in order to meet customer demand. PBL could enable the contractor more freely to choose what needs to be done in order to meet customer requirements of system performance. PBL model is designed to adapt to the requirements of new combat environment and new combat style for

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equipment support, reduce the size of the logistics, security, decrease using cost or maintenance cost, improve the economic sustainability as well as the operational readiness of the equipment. In the few years of the PBL implementation, U.S. forces has made great achievements. Currently it has developed into the premier logistics support strategy of Department of Defense. So we will consider applying PBL strategy for airline maintenance outsourcing projects to reduce the size of the logistics, decrease using cost or maintenance cost, improve the economic sustainability as well as the operational readiness of the equipment.

Maintenance outsourcing is a form of enterprise resource outsourcing. For airlines, maintenance outsourcing has become a very important management mode for reducing maintenance cost and obtaining professional skills support. In the United States, the airline maintenance outsourcing business developed rapidly. In 1996, U.S. major airlines spent 1.5 billion dollars for the outsourcing of maintenance which account for 37% of the total maintenance cost. And in 2002, the cost reached 25 billion dollars, accounting for 47% of the total maintenance cost. In 2003, outsource workload will be more than 50%.

However, currently, the study of maintenance outsourcing have been rare at home and abroad. Especially, the research of airline maintenance outsourcing is much less, So far there has not a set of complete and scientific theoretical system of maintenance outsourcing as a guide.

With the new regional airliner ARJ21 has been under final assembly line and on stream. After put it into operation, the problem of maintenance is extremely urgent. Airlines is crying out for a set of complete and scientific theory of maintenance outsourcing as a guide for their maintenance outsourcing to ensure its smooth operation and to achieve its scientific management.

2 The reasons for Airline maintenance outsourcing and existing problems

2.1 The reasons for Airline maintenance outsourcing

Maintenance outsourcing unique advantage is an important reason of airline maintenance outsourcing. Its advantages can be summarized as follows:

1. Maintenance costs can be reduced effectively

The U.S. government, as evidenced by 2005 year's report from the U.S. Department of Transportation's

Inspector General, has serious concerns about outsourcing implementation and oversight. Outsourcing has become an integral and growing part of today's cost-conscious airline industry. According to a new agreement between UALAQ and its machinists union, maintenance bases will be shut down in the Indian Annapolis and the Oakland. The airframe maintenance and 20% of the other maintenance work will be allowed to be outsourced. it has been calculated that UALAQ airframe maintenance and its related maintenance costs is about 75 to 85 dollars per hour before the new contract is signed. If maintenance is outsourced, the cost per hour is about 40 to 48 dollars. UALAQ will become the industry leader. Before 2005, Midwest Airlines performed all of its heavy maintenance inhouse. When it acquired the Boeing 717, the company found that its inhouse maintenance requirements were diminishing and started looking for a quality MRO. Eventually, Midwest chose Empire Aero Center of Rome, N.Y., for its MD-80s, a move that has saved the airline "millions of dollars" in annual maintenance costs.

2. To Focus on core competence

Airlines can effectively use their limited resources to focus on improving its core capabilities in order to ensure that it could get long-term high profits.

3. TO obtain professional skill and technological updating

Airlines will outsource the non-core maintenance business to professional maintenance suppliers, at the same time they could obtain a great amount of professional skill of suppliers and technological updating at any time.

4. To reduce the risk

Through outsourcing, airlines can establish strategic alliances with maintenance suppliers, use the Competitive resources of maintenance suppliers, shorten the maintenance cycle, improve the quality of maintenance and reduce the risk of the operation reliability caused by maintenance. Maintenance outsourcing can pass on operational risk to maintenance suppliers. As a result, it can reduce the risks by the airlines.

5. To improve the reliability of the operation

Airlines improve the quality of maintenance and obtain new technologies taking advantage of the professional skill of maintenance suppliers, and it is in favor of improving the reliability of the operation. At the

same time, the passengers quick and safety requirements have been met.

2.2 At present, the airline maintenance outsourcing problems

In the face of overwhelming wave of outsourcing, airlines have opportunities and challenges. Opportunities are: in the new century, the revolution of the global enterprise organization form and the mode of production will rewrite the shape of the global economy, as well as the world large enterprises rankings. Yet the outsourcing strategy for the airline in the fierce competition to get the victory provides an important means and Way. It contains much useful experience and inspiration for the airlines to transform the old mindset, cultivate core competitiveness, simplify the organizational structure, reconstruct business culture, as well as enhance the quality of the staff and so on. However, in practice, the results of many airlines outsource are often not so ideal. A lack of Outsourcing theoretical understanding and awareness, blind decision-making, ineffective management, will eventually be counter-productive and lead to waste of resources and loss of competitiveness. So some of the questions to ponder are: How can airlines and their maintenance providers better manage, track and improve the outsourcing process? What innovative oversight methods have airline managements implemented? What information technology (IT) systems have operators acquired to make the outsourcing more cost- effective and efficient? Specific as follows:

1. Which maintenance programs should be outsourced for the airline? If outsourced, what kind of maintenance outsourcing strategy should be chosen?
2. How to scientifically choose and determine the outsource maintenance supplier?
3. How to formulate an effective long-term maintenance contract to ensure high-quality and low-cost maintenance services, and improve the fleet's availability, reliability and maintainability?
4. How to effectively evaluate the performance of outsourcing maintenance?
5. How to evaluate and control the risk of maintenance outsourcing?

3 Domestic and foreign airline maintenance outsourcing management

(1) Most foreign airlines have very stringent criteria for choosing and evaluating the providers. At the top of the list is an unbending insistence on quality and safety.

Most MROs undergo an in-depth audit of their maintenance operation initially.

In the aspect of selecting maintenance suppliers, in general, airlines inspect the quality of maintenance suppliers workmanship and reputation before they ever entertain sending work there. And in the choice of maintenance suppliers, airlines have their own methods. For example, Midwest Airlines use their own experience and expertise as a foundation for evaluating and choosing MROs. And Continental Airlines choose maintenance provider according to the audit results of the maintenance supplier audit checklist. Vueling Airlines, another European carrier, hired a consulting group with considerable experience in outsourcing to help it choose a vendor. For United Airlines, each new supplier of United is carefully selected using cross-functional teams from sourcing, production, engineering, quality assurance, inspection and vendor management divisions.

In the aspect of outsourcing program management, Each airline has its own way to treat these issues. Some freight carriers have very detailed and comprehensive contracts for heavy maintenance. It's all negotiated upfront. They do not send representatives for on-site supervision, because maintenance supplier is well aware of their needs.

While once the MRO is chosen, the other airlines generally dispatch on-site teams to monitor and evaluate the maintenance work. For example, Aegean Airlines, a European carrier has incorporated three levels of protection in contracts when outsourcing maintenance. First, Aegean's outsourcing contracts clearly designate the responsibilities of the airline and the contract partner. Secondly, the contract specifies that the maintenance takes place within the prescribed timeframe and that airline personnel on site maintain a tight control of the process. The third area is invoice analysis. Invoices require in-depth review with personnel that are trained and have experience on such control. The vendor maintenance oversight program has been so successful that Alaska has identified it as a best practice of oversight for other parts of the airline. Alaska Airlines' four-step vendor maintenance oversight program requires vigorous and frequent reporting on quality, performance and cost. Through the program, they ensure vendor (outsourced) maintenance is performed to the highest quality standards in an appropriate time frame and within

cost expectations. The program consists of several steps. First, Alaska evaluates the potential MRO partner through an extensive Request For Proposal (RFP) process that rates the MRO against a qualitative and quantitative report card. The selection process can take up to six months. Once a vendor is selected, oversight teams establish the metrics by which the chosen MRO's performance will be judged. Third, the oversight team measures the MRO's performance daily. Lastly, each quarter, Alaska conducts in-depth monthly performance reviews with the MRO. The quarterly meetings provide an opportunity to discuss possible adjustments to the maintenance process to optimize performance. For airframe maintenance, the vendor oversight team includes management and unionized employees responsible for product, quality control, quality assurance and material control.

In the aspect of Maintenance outsourcing decision-making, European Vueling Airlines hired a consulting group with considerable experience in outsourcing to conduct a review of Vueling's outsourcing and insourcing strategy, assessing what, and when, different tasks should be outsourced. In the performance evaluation, in general, for airlines, Key performance indicators (KPIs) and performance measures were built in the contract that had a bonus malice system. Here is no longer one by one illustrated.

(2) As domestic airlines do not have the sophisticated maintenance equipment, advanced technology as well as maintenance staff, almost the majority of the body and engine maintenance are outsourcing. So the management of maintenance outsourcing is very important for the domestic airlines. Currently, major airline maintenance outsourcing mode includes long-term and short-term contract maintenance outsourcing, and single packet-based is a major mode in short-term contract repairing.

Next, take the engine maintenance outsourcing for example. For long-term maintenance outsourcing, the first, airline will determine whether to adopt long-term maintenance outsourcing, as well as the maintenance outsourcing scope and duration through the cost estimating. Then, they can choose the maintenance supplier with a reasonable quotation and considerable maintainability through the quotations of maintenance suppliers. In the contract, due to the long-term maintenance outsourcing, the majority of airlines will

outsource all the maintenance work to suppliers, including spare parts from suppliers. Airlines only pay per flight-hour. As a result, in the negotiations, the two sides only need to consult the per flight-hour cost, as well as dual responsibility, performance indicators and so on. In the course of the implementation of the contract, the airline will carry out a cost settlement and the assessment of the maintenance performance every year. And each repair decision-making will be made by the mutual consultation of airlines and maintenance provider, maintenance requirements, as well as spare parts and engines are supplied by suppliers. Because their maintenance costs are borne by the suppliers of maintenance, and the airline only pay the per flight-hour cost, do not have to bear the cost of maintenance, at each maintenance, the airline will send an experienced maintenance engineers on site to supervise maintenance work of Supplier. For short-term maintenance outsourcing, most of the airlines adopt single service repair. First, the removing engine decision has to be decided by the airlines. After removing engine, the Department of airline maintenance will make workscope in accordance with engine conditions, and then distribute it to the maintenance suppliers for competitive bidding. Finally, the airline will choose an appropriate maintenance supplier and enter into a maintenance outsourcing contract. When the engine is returned after repair, the airline will assess this maintenance as a basis for the next repair.

4 Conclusion

Through the analysis of airlines' maintenance outsourcing management methods at home and abroad, this paper gives the basic processes of airline maintenance outsourcing operation and maintenance outsourcing management decision support system.

(1)The basic processes of airline maintenance outsourcing operation

In general, before outsourcing, Airlines will carry out the forecast of maintenance work, the preparation of maintenance programs and the planning of maintenance scope. At the same time, they will carry out the maintenance costs analysis of self-made and outsourcing, and ultimately determine the specific maintenance work. We can call the work as decision-making phase of maintenance outsourcing and the strategy selection phase of maintenance outsourcing. After completing the above work, the next is the choice of maintenance suppliers.

Specific audit works include maintenance work history, the quality of work, the overall capacity, turnaround time(TAT), The work level of maintenance staff and engineering support capabilities, whether to possess continuous improvement capacity, quality assurance capacity and ability to self-audit, training capacity ,security, reputation and so on. The next is to enter into a maintenance outsourcing contract. Its main tasks include declaring clearly the responsibility of two sides, the provisions of the contract period, key performance indicators (KPI), performance standards and the reward and punishment mechanism. Next is the process management of maintenance outsourcing. In

general, airlines will send inspection teams on-site supervision of maintenance provider' maintenance. And they are responsible for the product, quality control, quality assurance, materiel control and management. Finally, the airline will make the performance evaluation of maintenance suppliers and assessment of outsourcing risk, and make the final decision on whether to suspend the contract. Through the summary of airlines' maintenance outsourcing management methods and the Operation process at home and abroad. In this paper, the basic operation processes of the airline maintenance outsourcing is given as chart 1,

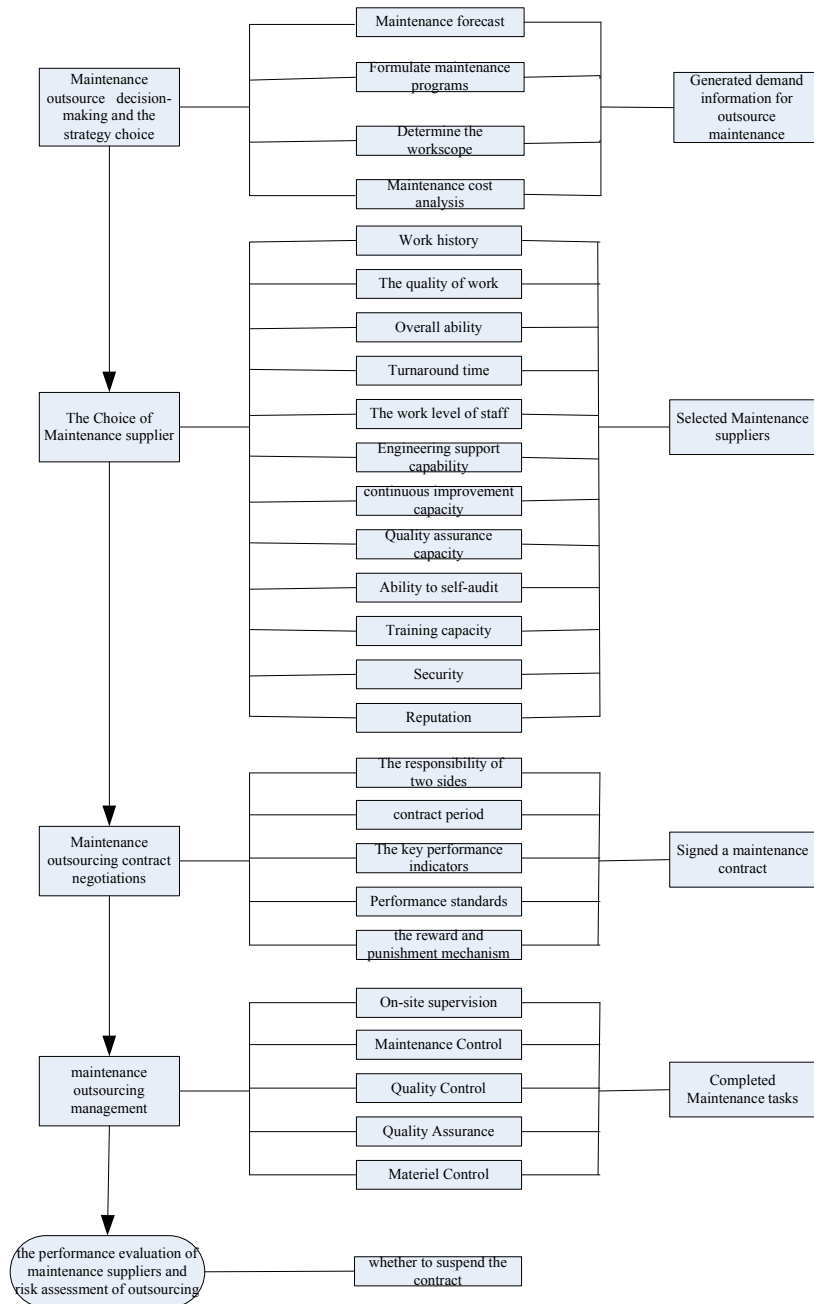


chart 1 the basic operation processes of the airline maintenance outsourcing

(2) The management decision support system of airline maintenance outsourcing

Through the above analysis of maintenance outsourcing process, we can see that for as long as they can carry out scientific management for maintenance outsourcing and the stringent quality assurance procedures, maintenance outsourcing will be able to achieve lower costs and improve logistics support rate. So, it is very important to research maintenance outsourcing strategy principle, the current domestic and foreign outsourcing maintenance status and apply current research to further explore the

related issues of outsourcing operation and management.

The establishment of a set of complete maintenance outsourcing management decision-making support System could provide a scientific complete and strong operational guidance tool for airlines. In view of this, this paper preliminarily explores maintenance outsourcing management decision-making support System and proposes the modular design of maintenance outsourcing management decision-making support System based on PBL in Figure 2:

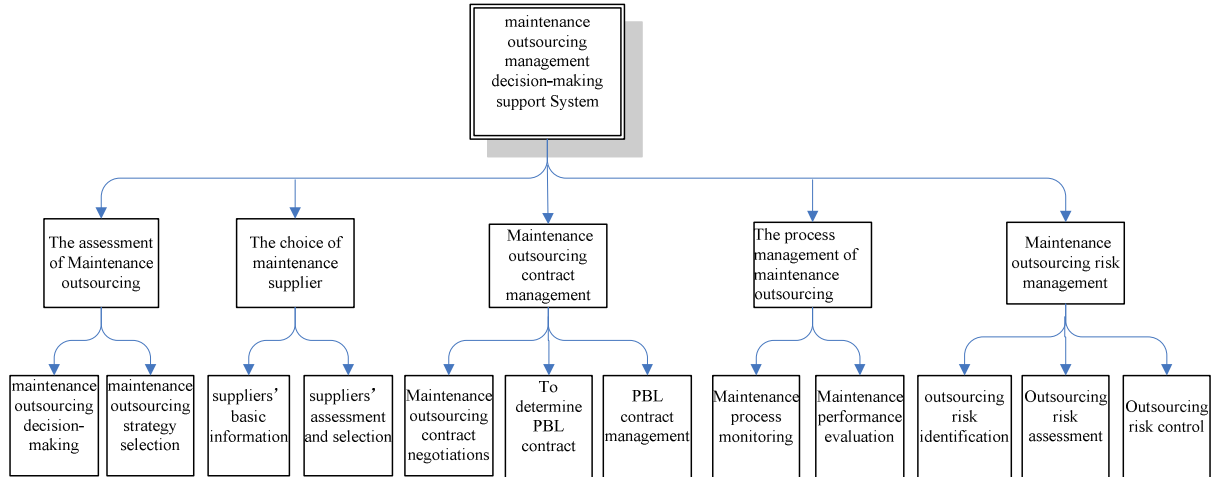


Figure 2 the modular design of maintenance outsourcing management decision-making support System based on PBL

(1) The assessment of Maintenance outsourcing

The functional module is to conduct a review of outsourcing and insourcing strategy through the analysis of the basic maintenance information and maintenance costs of airline's available aircraft and engines. If outsourcing, which outsourcing strategy will be adopted. First of all, the maintenance outsourcing decision-making factors should be determined, and then all decision-making factors' weights will be assigned through the module's expert system. Finally, the outsourcing decision-making and strategy selection will be determined through the module.

(2) The choice of maintenance supplier

The function of this module is to carry out detailed analysis of maintenance tasks through the collection and management of suppliers' basic information as well as previous cooperation history and to choose the best supplier by the module of suppliers' assessment and selection functions.

(3) Maintenance outsourcing contract management

The key to outsource success is to develop a reasonable PBL contract. Therefore, through the cost-benefit model, the use of the Nash equilibrium theory of the game, the optimal pricing structure the equipment performance index and the criteria for evaluation indicators will be determined in the contract.

(4) The process management of maintenance outsourcing

In this module, the decisive part whether to continue outsourcing is the performance assessment of maintenance. Airlines can evaluate the maintenance

performance of suppliers to decide whether to continue outsourcing.

(5) Maintenance outsourcing risk management

The first step is the outsourcing risk identification. It will provide information for the risk assessment through the analysis of risk factors, risk identification and management. The use of risk assessment model is to assess and effectively control the risk.

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